the far more extensive and methodical experience of Benedict and Murchhausen, as quoted above.

Conclusion.

In conclusion, we wish to repeat and emphasize our opinion that the measurement of primary importance to our further knowledge of the physiological cost of industrial labour consists in the measurement of CO_2 expired during the day's work—recording the CO_2 values observed as ordinates throughout the day.

A fixed factor for an approximate conversion of CO_2 values into calories may be used in order to compare the findings by the short method with those of other observers by the long method. In cases where both methods are applicable we find that the results come out very close together.

In our opinion the most satisfactory and accessible test case is afforded by the cost of walking on a horizontal path at ordinary speeds—80 to 100 metres per minute ($= 3$ to $3\frac{1}{2}$ miles per hour). At 80 metres per minute we find by the short method that a subject "fit for military service" expends approximately $1/10$ c.cm. CO_2 per second to carry 1 kilo of his body 1 metre horizontal—a finding that corresponds with that of other observers—for example, Benedict, of 0.5 calorie per horizontal kilogram metre.

As regards the relative (numerical) accuracy of the two methods, we should be very glad to find an opportunity of carrying out upon the same subjects simultaneous observations in parallel by the short and by the long method. We believe that it would be found that the relative accuracy of the two methods would prove to be very close by reason of the fact that the number of observations to be obtained is much greater by the short than by the long method.

The systematic measurement of the physiological cost of industrial work cannot be accomplished by the isolated effort of private enterprise; it requires the support of team work and the services of many industrious if not highly skilled professional researchers. The long method is impracticable without undue disturbance of the workman; indeed, no recent attempt has been made to apply it to "the determination of the energy output of men and women workers," or if such attempt has been made, the results have not been reported. The purpose of our observations of the last two years has been to show by actual trial at the docks, at the coal-face, and in the workshop that this physiological aspect of the industrial problem can be approached by a suitable method.

P.S., October 1st.—We are glad to learn that there is a prospect of carrying out for the Industrial Fatigue Research Board a parallel series of measurements by the long method and by the short method.

Our justification for taking the figure 0.85 as our standard value for the respiratory quotient consists in the experience of many previous observers (including ourselves), who have found that, apart from its spurious fluctuations, the true value varies very slightly from this mean value—thus, for example, in the series of observations given by Benedict and Murschhausen on p. 50 of their monograph on the *Energy Transformations during Horizontal Walking*, the average value of the respiratory quotient for the series of readings taken on four successive days—December 17th, 18th, 19th, and 20th—upon their subject, A. J. O., comes out at the identical value 0.8475 when the subject is standing at rest (twelve observations) and while he is walking at about 105 steps per minute (sixteen observations).

REFERENCES.

¹ *Proceedings*, 1919, B, vol. 91, p. 166. ² Waller, Calibration of a Dock Labourer by means of his CO_2 Discharge, *Proceedings Physiological Society*, December 14th, 1918. ³ *Energy Transformations during Horizontal Walking*, Carnegie Institution Report, No. 331, pp. 92-93.

THREE new cinematograph films have been produced by the New York State Department of Health, and are lent free of charge within the state; these films are entitled "Mouth hygiene," "Saving the eyes of youth," and "Swat the fly." The Health Department is now co-operating in the production of a film on water supply in farms; two reels are devoted to showing the rural resident how he can install a complete plumbing system in his house, and the difficult parts of the plumber's trade are shown in detail.

GLYCOSURIA OF MALARIAL ORIGIN.*

BY

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I WAS particularly interested to read the account of the two cases published by Dr. A. Castellani and Dr. J. G. Willmore in the *BRITISH MEDICAL JOURNAL* of August 20th, 1921. Recently Sir Charlton Briscoe asked me to investigate a case of glycosuria, and the conclusion was reached that the condition must have been due to malaria. On referring to several textbooks of medicine, no mention of glycosuria of malarial origin could be found. Castronuovo, however, regards malaria as important in the etiology of some cases of diabetes mellitus. (See *Medical Science*, iv, 6, 497, September, 1921.)

A Jewish merchant, aged 32, went to Bombay in 1919. In March, 1920, he was in bed for three weeks with "dysentery and colitis." He then went to Indore for further treatment and to convalesce. Whilst there he developed malaria. Parasites were found in his blood, but for three weeks only did he continue quinine treatment. The ague stopped, but he had a relapse a month later. During the following six months he had a series of relapses, but did not take any more quinine. In March, 1921, he sought professional advice on account of excessive thirst. He thought that he had lost about 7 lb., but did not consider that he had been passing an unusual amount of urine; he never had to rise at night to micturate. He had been much worried by his business. Sugar was found in his urine, and a diagnosis of diabetes mellitus was made. Carbohydrates were reduced; the glycosuria decreased considerably, but was still present when he left India in May, 1921. In June, after arrival in England, sugar was again discovered, but in July Sir Charlton Briscoe found no trace.

The patient stated that he had had a "mastoid abscess and glands" at 14; an operation for removal of adenoids at 16; scarlet fever at 18; and an operation for removal of nasal septum at 27 under a local anaesthetic. The operations were successful; no post-operative complications were noted. His father died at 45 of "creeping paralysis." His mother is alive and well, aged 61. He has one brother and two sisters, all very healthy. His maternal grandfather and maternal grandmother both died from "diabetes" at the age of 72 and 70 respectively.

The patient first saw me on June 28th, 1921. He had just recovered from another relapse of malaria, having had ague on June 23rd, 25th, and 27th at mid-day. I examined samples of blood and urine, and advised him to come into hospital for further investigation.

Blood.—Fairly large number of benign tertian malarial parasites present; haemoglobin 90 per cent.; red blood corpuscles not counted; white blood corpuscles 9,600, polymorphs 73.6 per cent., eosinophils 0.4 per cent., lymphocytes 24.4 per cent., large mononuclears 1.2 per cent., mast cells 0.4 per cent.

Urine.—No albumin, no sugar, no acetone nor aceto-acetic acid; urobilin present in large amount.

He came into hospital on the evening of June 29th; his blood still showed malarial parasites, but they were fewer in number than on the previous day. There had been no further attack of ague. No quinine had been taken before admission; 10 grains were given by mouth later in the evening; 30 grains a day were prescribed for the next three days, followed by 20 grains daily for a fortnight, and 10 grains daily for a further two months. The urine again contained no sugar. A full diet, including sugar, was ordered.

On examination on June 30th, 1921, the patient was well nourished, the skin slightly pigmented, the conjunctivae had a sub-icteric tinge, the glands were nowhere enlarged, and his general condition appeared excellent. Pulse, temperature, and respiration were normal. His weight (in clothes) was 11st. 9 lb. His teeth were in good condition, there was no pyorrhoea; nothing abnormal was to be seen in the mouth or throat. Thyroid, heart, lungs, and abdomen all appeared normal. Blood pressure was 105/85; liver and spleen were not palpable. His pupils reacted to light and accommodation; knee-jerks were present; the plantar reflex was flexor.

A specimen of the twenty-four hours' urine (52 oz.) examined on July 1st contained a very slight trace of sugar, no albumin, no acetone, no aceto-acetic acid, but a trace of urobilin. The sugar did not exceed 0.2 per cent. in concentration. Typical glucosazone crystals were easily obtained. No rotation was observed with the crude polarimeter available. After fermentation with yeast, the urine no longer reduced Benedict's solution, yet no gas had been collected in the inverted tube. Bial's test, and the phloroglucin hydrochloride test were both negative. The reducing substance was therefore, in all probability, glucose. Wassermann reaction, negative.

Sixteen different specimens of urine were tested for sugar in the next five days, all with negative results. The volume of the urine in the twenty-four hours was always normal, the highest measurement recorded being 54 oz. During his week's stay in hospital the following results of tests were obtained.

* This investigation will be included at a future date in a report to the Medical Research Council.

(1) *Pancreatic Function*: Loewi's adrenaline mydriasis test, negative; diastase in blood plasma, 6.7 units (normal); diastase in urine, 20 units (normal); creatorrhoea, nil; steatorrhoea, nil; bulk and general appearance of faeces, normal.

(2) *Kidney Function*: Albuminuria, nil; deposit, nil; oedema, nil; urea concentration test (Macleod and de Wesselow)—at end of first hour, 1.87 per cent. (vol. 240 c.cm.); at end of second hour, 2.34 per cent. (vol. 120 c.cm.), that is to say, a normal result. Diastase in blood and urine (see above), normal.

(3) *Blood*: Sugar curve July 5th, 1921, after 50 grams glucose

on an empty stomach in the morning, result normal, though it was unfortunate that no estimate was made thirty minutes after the dose of sugar. Glycosuria, nil throughout test.

Remarks.

The diagnosis of "glycosuria of malarial origin" is preferred to that of "very mild diabetes mellitus in a malarial subject," owing to the negative findings in a fairly exhaustive clinical and chemical study. The family history of diabetes would naturally suggest caution. The case should be a very instructive one with which to keep in touch for several years. It is unfortunate that, while under my observation, the nature of the reducing substance in the urine could not have been more conclusively established, but the history makes it extremely unlikely that it was anything but glucose.

It is interesting to speculate as to the site of action of the malarial toxins. Possibly the glycosuria may have been due to diminished glycogenic function of the liver and other tissues. Presumably the urobilinuria resulted from destruction of red blood corpuscles by the malarial parasites, but, in part at any rate, may have been due to the effect of their toxins upon the liver. The islands of Langerhans may have suffered from the toxic action, so that the supply of internal secretion was insufficient to prevent glycosuria on a full diet. Against this is the fact that all the pancreatic function tests performed were negative; it would probably be objected, however, that such tests are too crude. Owing to toxic action on the kidneys their "leak point" temporarily may have been lowered. The type of blood-sugar curve may be said to give some slight support to this hypothesis, for it is not altogether unreasonable to imagine that four days after evident glycosuria the curve should have revealed some degree of hyperglycaemia unless the glycosuria was of the renal type.

Lastly, we may picture a toxic influence on several of the ductless glands, so that the balance between their secretions was upset in such a direction as to cause glycosuria. Of course, there is always the possibility of two or more of the above causes being simultaneously at work. Such theorizing may seem a waste of time and space, but obviously suggests several possible lines of research in malarial patients that might be of interest if not of real value; for instance, (1) examination for glycosuria before treatment, and (2) blood-sugar curves to decide, among other things, if the glycosuria is renal in origin.

Turning now to the malaria itself in this particular case, the differential blood count is noted as unusual (250 cells were counted). Though probably of common knowledge to pathologists with experience in malaria, it was of interest to me to find a number of benign tertian parasites in the peripheral blood (on June 28th and 29th) without any further attack of ague. As in the two cases previously published, so in this instance the glycosuria cleared up with quinine in the absence of dietetic treatment; in fact, sugar was deliberately included in the diet throughout the stay in hospital.

OVER FIVE HUNDRED GALLONS OF FLUID FROM AN OVARIAN TUMOUR.*

BY

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AND

G. A. GIBB, M.D.

The cyst from which this fluid came was noticed in 1893, when a surgeon was consulted and advised against operative treatment. The abdomen was tapped in the autumn of that year. There is no record of the tappings until 1904, but as a conservative estimate there were twenty-five before that date. G. A. Gibb has kept a record since then. The tappings increased gradually from four in 1904 to from thirty-four to thirty-six in each of the last four and a half years. The amount removed was always as nearly as possible 11 pints, and, counting twenty-five for the first ten years, there were 368 tappings in all. Taking 11 pints on each occasion, the total is 4,048 pints, or 506 gallons, which would weigh considerably over two tons.

In 1899, after about six years' tappings, the late John Langton tried, and failed, to remove the tumour. On July 20th, 1906, John D. Malcolm tried again, with the same result.

Almost to the last the condition of the patient was fairly good. She got up and about and ate enormous quantities of food, except just before the tappings, when she suffered from nausea and vomiting. The legs were oedematous as early as 1906.

The tappings in recent years were always performed with a trocar and cannula having a diameter of one-eighth of an inch. The evacuation was usually completed in about fifteen minutes. There was never any adverse symptom. Occasionally the puncture leaked, and then the need for the next tapping was delayed. Hard masses remained after each tapping, and these were never the same shape.

On June 30th, 1921, when a tapping was about due, the patient was seized with abdominal pain and vomiting, and she was tapped without relief. One-third of a grain of morphine hypodermically removed the pain, but vomiting continued, and the patient died early on July 6th at the age of 67.

At the autopsy 4½ pints were removed, leaving a secondary cyst five inches in diameter lying on the left pelvic brim. It was obvious that this secondary cyst would soon have burst into the main cavity, and that a development and rupture of secondary cysts caused the constant change of shape observed after the tappings. There was also much papillary growth from the cyst wall. A piece of this was described by Dr. C. Fletcher as having

"the histological structure of a serous papillary cyst of the ovary. The epithelium covering the papillary processes is of a low columnar (cuboidal) type, and there is in places a deposition of salts from the secretion. The stroma is of very dense fibrous tissue with areas of commencing infiltration with lime salts. The tumour is innocent."

As in 1906, the cyst was everywhere firmly adherent, and its wall was so friable that many hours of careful dissection would have been necessary to remove it. The intestines occupied a very small space at the back of the abdomen. They were not distended. No peritoneal cavity was found. The liver when exposed was smooth and not enlarged. The other organs were not examined.

One of us (G. A. Gibb) has found the following record on a tombstone in Bunhill cemetery, City Road, E.C.:

"Here lies Dame Mary Page, relict of Sir George Page, Bart. She departed this life March 11th 1728 in the 56th year of her age. In 67 months she was tapped 66 times: Had taken away 240 gallons of water without ever repining at her case or ever fearing the operation."

Possibly this lady had an ovarian tumour.

Sir John Bland-Sutton has drawn our attention to a case recorded by Dr. Pye-Smith.¹

Dr. Pye-Smith's case was that of a woman suffering from papilloma of both ovaries with secondary deposits on the peritoneum; she was tapped 299 times in Guy's Hospital between 1884 and 1893, when she died at the age of 44. The

* This case was referred to in the President's valedictory address to the Obstetric and Gynaecological Section of the Royal Society of Medicine in 1920. Proceedings of Section, vol. xiii, p. 212. The record is now complete.